

LA-UR-21-24497

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Title: Direct Air Capture of CO₂ (DAC)

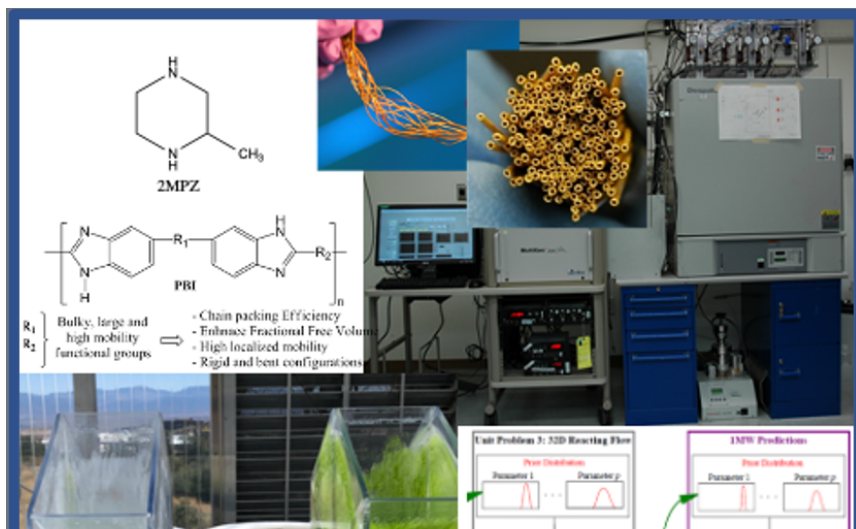
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Intended for: Web

Issued: 2021-05-10

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Tech Snapshot Earth and Environmental

Published: May 5, 2021

DIRECT AIR CAPTURE OF CO₂ (DAC)

Capabilities to Make Direct Air Capture of Carbon Dioxide More Efficient, Economic, and Scalable



SUMMARY

Researchers at Los Alamos have extensive capabilities in design, testing and optimization of: (1) new capture materials based on membrane separation, amine and other solvent and sorbent separation, and porous materials; (2) biological capture methods, particularly algae and plants; (3) full-scale systems using science-based virtual learning; and (4) system performance under specific meteorological conditions, impacts of CO₂ capture via atmospheric data and simulations, and availability of energy and storage capacity. The goal for Los Alamos is advancing our physical technologies and engineered systems approaches from the development phase to a minimal viable product in the energy sector for commercial purposes. Los Alamos is seeking strategic commercialization partners to work with us in advancing these capabilities and technologies for commercial viability.



MARKET APPLICATION

Separation processes for the capture of CO₂ from the atmosphere will be an industrial process of significant scale to meet climate targets, with the primary market opportunities in the energy and government market sectors. Los Alamos researchers are leveraging fundamental knowledge in physics, materials, chemistry, bio- and earth- sciences, and theory. These capabilities are supported at every scale by our distinctive capability in modeling, simulation, and high-performance computation.

BENEFITS

Our capabilities in Direct Air Capture provide the potential to develop technologies for more efficient, cost effective, and scalable solutions in an environmentally responsible manner.

- Extensive facilities for synthesis of materials having controlled functionality for CO₂ separations and utilization at length scales from atomic through macro, coupled with testing from the bench-scale through pre-pilot scale-up.
- Systems design and scale-dependent assessment leading to improved economics of capture systems.
- Real-time on-site field measurements of CO₂ to optimize efficacy of air capture facilities.
- Advanced engineered bio systems through gene regulation and directed evolution to develop custom bio derived scalable solutions.
- Seamless integration of experimental and computational capabilities.
- Data science solutions applied to materials development, Earth sciences, biological systems, and chemical sciences.

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WHY WE ARE BUILDING DIRECT AIR CAPTURE OF CO₂ (DAC)

Congress and the Executive branch through the Department of Energy (DOE) have established National priorities in de-carbonization of the U.S. Economy. As a federally funded research and development center (FFRDC) for DOE for more than 75 years, our laboratory capabilities in material science, chemistry, life sciences, modeling and simulation, and advanced computation leverage greater than \$3 billion in annual government investment to address problems of national and global importance. We leverage extensive experience and expertise in DOE projects in carbon capture, utilization, and storage. Our unique ability to integrate and couple experimentation with field observation and advanced supercomputing across scales in physical models and engineered systems positions us well as a partner to industry and the commercial sector to address the many aspects of de-carbonization goals. Direct Air Capture of CO₂ will be a necessary and significant component of restructuring U.S. energy systems to achieve these goals.



WHAT'S BEHIND OUR TECHNOLOGY

Los Alamos has multiple technological approaches to the Direct Air Capture problem, including solvent- and sorbent-based capture, advanced membrane systems, biological systems capture, and atmospheric analysis for siting. The distinctiveness of our approaches is the leveraging of LANL's high performance computation and modeling expertise, laboratory and field observation skills that bridge scales from molecular behavior through materials characterization to engineered systems performance. Our expertise in the applied physical technologies and models leverages experimental observations with models to enhance agility and impact to capture technologies.



OUR COMPETITIVE ADVANTAGES

Los Alamos brings together an end-to-end capability, from fundamental chemistry, physics, and biology knowledge and models, through state-of-the-art laboratories for full analytical characterization and facilities for developing prototypes, small-pilot level scale-up opportunities, up to full-scale deployments and all in a collaborative environment. Our capabilities could significantly reduce the time to develop new innovative de-carbonization technologies that are efficient, economic, and scalable in an environmentally sustainable manner.



OUR TECHNOLOGY STATUS

We are seeking strategic commercialization partners to work with us to further develop our capabilities and technologies at all levels, with the goal of bringing our physical technologies and engineered systems approaches into scale-up from the development phase to validation phase, to testing and application phase, to a minimal viable product to market in the energy sector for commercial purposes. Our researchers have extensive experience, interest, and willingness to work diligently with a commercialization partner to achieve our mutual goals.



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